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ABSTRACT

Given the methodological problems with generating and using normative data with the elderly, the need for age-related norms on neuropsychological tests is clearly important. A study was conducted to examine a normal elderly group's performance on the Luria-Nebraska Neuropsychological Battery (LNNB) over time. Subjects were 57 elderly volunteers seen in an earlier (1983) aging study. At Time 1 subjects reported no history of: psychiatric hospitalization, significant neurological impairments, seizure disorder, significant cardiovascular disease, or alcohol or drug use. Form I of the LNNB was administered to all subjects at Time 1 and Form II was administered 34 to 51 months later. In addition, the health status of each subject was rated by a physician. Analyses of data revealed that test-retest correlations ranged from .31 to .80 on the LNNB Clinical Scales and .54 to .75 on the LNNB Localization Scales. The results indicated that the LNNB group profiles at both time periods were very similar. Few differences appeared when males and female were compared. Similarly, being in an older subgroup did not appear to affect the rate of change. Finally, it was found that global physical health ratings were related to changes in LNNB performance over time. (Author/NRB)

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Longitudinal neuropsychological changes in a "normal" elderly group

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Abstract

Given the methodological problems with generating and using normative data with the elderly, the need for age-related norms on neuropsychological tests is clearly important. This study will examine a "normal" elderly group's performance on the Luria-Nebraska Neuropsychological Battery (LNNB) across 34-51 months.

This report is based on the analyses from 57 elderly volunteers seen in an earlier aging study (MacInnes, et al, 1983). The test-retest correlations ranged from .31 to .80 on the Clinical Scales and .54 to .75 on the Localization Scales. The LNNB group profiles at both time periods were very similar. Few differences appeared when males and females were compared. Similarly, being in an older subgroup did not appear to affect the rate of change. Finally, we did find that global physical health ratings were related to changes in LNNB performance over a four year period.

Longititudinal neuropsychological changes

in a "normal" elderly group

Numerous cross-sectional studies have suggested significant age-related differences across a variety of cognitive abilities. When declines have been detected in longitudinal studies they have tended to be very late in the life span and much smaller in magnitude than in cross-sectional studies (Botwinick, 1977). Research employing age as an independent variable involves its own unique methodological problems. Sampling is of critical importance in this regard. While random sampling strategies may give an accurate picture of what is normative for a construct such as intelligence, it is less useful when one is attempting to differentiate "normal" from "abnormal". Employing a random sampling stragegy in an elderly population would necessarily include persons with varying degrees of cognitive impairments such as Alzheimer's Disease, chronic obstructive pulmonary disease, alcoholism, hypertension, etc. If one of the purposes of giving a neuropsychological test battery is to detect the presence of brain dysfunction, it can be argued that the "reference" or "normative" group for a particular age sample at each measurement should be free of potential causes of cognitive impairment. However, subjects originally selected for health in a longitudinal study can develop illnesses which artificially magnify changes attributed to age when in reality the changes are due to the development of a physical disorder during the intervening time period. Therefore, when employing longitudinal designs it is critically important to assess health status at each measurement period to help determine the relative contributions of age per se versus age plus disease on changes in cognitive functions.

Given the methodological problems with generating and using normative data with the elderly, the need for age-related norms on neuropsychological

tests is clearly important. To date there has been no "normative" longitudinal data reported for any of the neuropsychological batteries in common use in the United States. This study will examine an elderly group's performance on the Luria-Nebraska Neuropsychological Battery (LNNB) across a four year time period. This study will also examine the interrelationships between sex, age-group, health status and longitudinal changes in cognitive functioning.

Methods

Subjects. The analyses are based on 57 of 78 elderly volunteers seen originally in an earlier aging study (MacInnes, et al, 1983). At Time 1 these individuals reported no history of: psychiatric hospitalization, significant neurological impairments, seizure disorder, significant cardiovascular disease, or alcohol or drug abuse. In addition, all volunteers were living independently in the community. The mean age of the 57 volunteers tested at Time 2 was 75.6 years (SD = 6.0). The mean years of education was 12.8 years (SD = 3.3). The sample was composed of 20 males and 37 females. There were 55 Caucasian, one Black and one Hispanic volunteers. Fifty-six subjects were right-handed and one reported being ambidextrous.

Procedures. The LNNB was administered to each individual at Time 1 and again 34 to 51 months later (Mean = 40.4; SD = 3.6). The LNNB is composed of 52 separate, but not totally independent scales: 14 Clinical Scales, eight Localization Scales, and 30 Factor Scales (see Golden, Hammeke & Purisch, (1980) for a complete description of these various scales). Form I of the LNNB was administered at Time 1 and Form II of the LNNB was administered at Time 2. Form II has been shown to exhibit high inter-scale reliability with Form I and eliminates many of the administrative difficulties in Form I (Golden et al., in press). For the purposes of intitial analyses the 14 Clinical and eight Localization Scales of the LNNB were compared across time.

Finally, the health status of each volunteer was rated by a physician

using the objective medical data (a physical exam, a neurological exam, blood and urine analyses and self report) using the "Cumulative Illness Rating Scale" developed by Linn, Linn and Gurel (1968). This index gives a summary score of global health status based on 13 dimensions. Each dimension can be scored 0-4, with zero indicating no impairment to four indicating extremely severe impairment. The summary score used in this analysis is simply the summation of thirteen rating scores.

Results

The test-retest correlations ranged from .31-.80 on the LNNB Clinical Scales and .54-.75 on the LNNB Localization Scales (See Table 1). Figure 1 shows the mean LNNB Clinical Scales profiles for Time 1 and Time 2. A repeated measures multivariate analysis of variance (MANOVA) using the LNNB Clinical Scales as the repeated dependent variables did show a significant change (F = 1.94, $p < .05$). However, when t-test comparisons were made comparing the Time 1 and Time 2 scores on the LNNB Clinical Scales only the Expressive Language Scale (t = 2.66, $p = .01$) and Arithmetic Scale (t = -2.60, $p < .02$) showed significant changes. Scores on the Expressive Language Scale improved by 3.0 T-Score points while scores on the Arithmetic Scale showed 2.0 T-Score points of impairment. Figure 2 shows the mean LNNB Localization Scales profiles for Time 1 and Time 2. A repeated measures MANOVA using the LNNB Localization Scales as the repeated dependent variables did not show a significant change across time.

It has been suggested by previous aging research that declines in cognitive functioning do occur over the age of 75. Individuals over 75 years old are often referred to as the Old-Old. Thus, we compared performance on the LNNB of the Young-Old (63-74 years old) to the Old-Old (75+ years old). Figure 3 shows the mean LNNB Clinical Scale profiles for these two age groups at Time 1 and

Time 2. A repeated measures MANOVA (using the LNNB Clinical Scales as the repeated measures) and agegroup as the independent variable found no significant differences between the Young-Old and Old-Old. Similarly, no change in LNNB score across time by agegroup interaction was discerned.

Figure 4 shows the mean LNNB Localization Scales profiles for the two age-groups at Time 1 and Time 2. A repeated measures MANOVA (using the LNNB Localization Scales as the repeated measures) and agegroup as the independent variable also found no significant differences between the Young-Old and Old-Old. Similarly, no change in LNNB score across time by agegroup interaction was discerned.

Sex was also examined as a possible determinant of change in cognitive performance. Figure 5 shows the mean LNNB Clinical Scale profiles for the two sexes at Time 1 and Time 2. A repeated measures MANOVA (using the LNNB Clinical Scales as the repeated measures) and sex as the independent variable found significant differences between the males and females (F = 2.52, p = .01). However, when univariate F's were calculated for each of the 14 Clinical Scales only the Writing Scale exhibited significant differences (F = 4.82, $p <$ .04). Females did significantly better in both cases. No change in LNNB score across time by sex interaction was discerned. Figure 6 shows the mean LNNB Localization Scale profiles for the two sexes at Time 1 and Time 2. MANOVA was calculated using sex as the independent variable and no differences were found across time. Similarly, no change in LNNB score across time by sex interaction was discerned.

Finally, the effect of overall health status at Time 2 was examined on changes in cognitive functions. The mean Cumulative Illness Rating Scale (CIRS) score (Linn, Linn & Gurel, 1968) at Time 2 for the entire group was 4.05 (SD = 2.7, Range = 0 - 10). Volunteers were divided into two groups based on their CIRS scores. Individuals with scores of four or less were placed in one group

and labelled as Healthy. Individuals with scores greater than four were placed in a second group and labelled as Mildly-Moderately Ill. Figures 7 & 8 show the mean T-Score profiles for the LNNB Clinical and Localization Scales for the Healthy and Mildly-Moderately Ill elderly adults. Repeated measures MANOVA (using the LNNB Clinical and Localization Scales as the repeated measures) and Health Status as the independent variable found no significant differences between the Healthy and the Mildly-Moderately Ill. Similarly, no change in LNNB score across time by Health group interaction was discerned.

Discussion

Overall, the LNNB group profiles were very similar across time. Few differences were detected between males and females. Likewise, patterns in performance across both time periods were also similar between the Young-Old and the Old-Old. The test-retest correlations for Form I and Form II of the LNNB were quite variable. One might question the reliability of the LNNB given the many low test-retest correlations for this sample. However, this sample was very homogeneous (all normal elderly adults) with a very restricted range of scores. This will tend to lower the correlations (Nunnally, 1978). Had we employed a more heterogeneous sample (including brain damaged and normals) the correlations would have probably been much higher.

This study's global measurement of health status did not detect significant differences in changes across time of LNNB performance in those subjects labelled as healthy or mildly-moderately ill. However, when Pearson correlations were calculated between LNNB T-Scores and CIRS scores significant correlations were seen on nine of the 15 Clinical Scales and six of the eight Localization Scales (See Table 2). Thus, it does appear health status is related to cognitive functions in this elderly sample. It may be that by not combining the Health Status Score into a single summation stronger relationships may be seen between changes in LNNB scores and health status. In

other words, health, like cognitive functions is a complex, multidetermined phenomenon. If we are to detect interrelationships between cognitve functions and health, both must be measured using multiple dimensions.

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TABLE 1

Correlations between Time 1 & Time 2 on the LNNB

CLINICAL SCALES

Scale	Corr.	Scale	Corr.
Motor	.57	Reading	.58
Rhythm	.74	Arithmetic	.78
Tactile	.37	Memory	.42
Visual	.46	Intellectual	.80
Receptive	.70	Pathognomonic	.58
Expressive	.54	L. Hemisphere	.44
Writing	.67	R. Hemisphere	.31

LOCALIZATION SCALES

LF	.75	RF	.58
LSM	.54	RSM	.54
LPO	.52	RPO	.65
LT	.65	RT	.66

TABLE 2

Correlations between Time 2 LNNB Scores and Overall Health Ratings

Scale	Corr.	Scale	Corr.
Motor	.35	Reading	.31
Rhythm	.28	Memory	.32
Visual	.23	Intellectual	.23
Writing	.40	L. Hemisphere	.29
LF	.30	RF	.29
LSM	.43	RSM	.27
LPO	.40	RT	.29

FIGURE 1
Longitudinal Changes in LNNB Clinical Scales in a Normal Elderly Sample

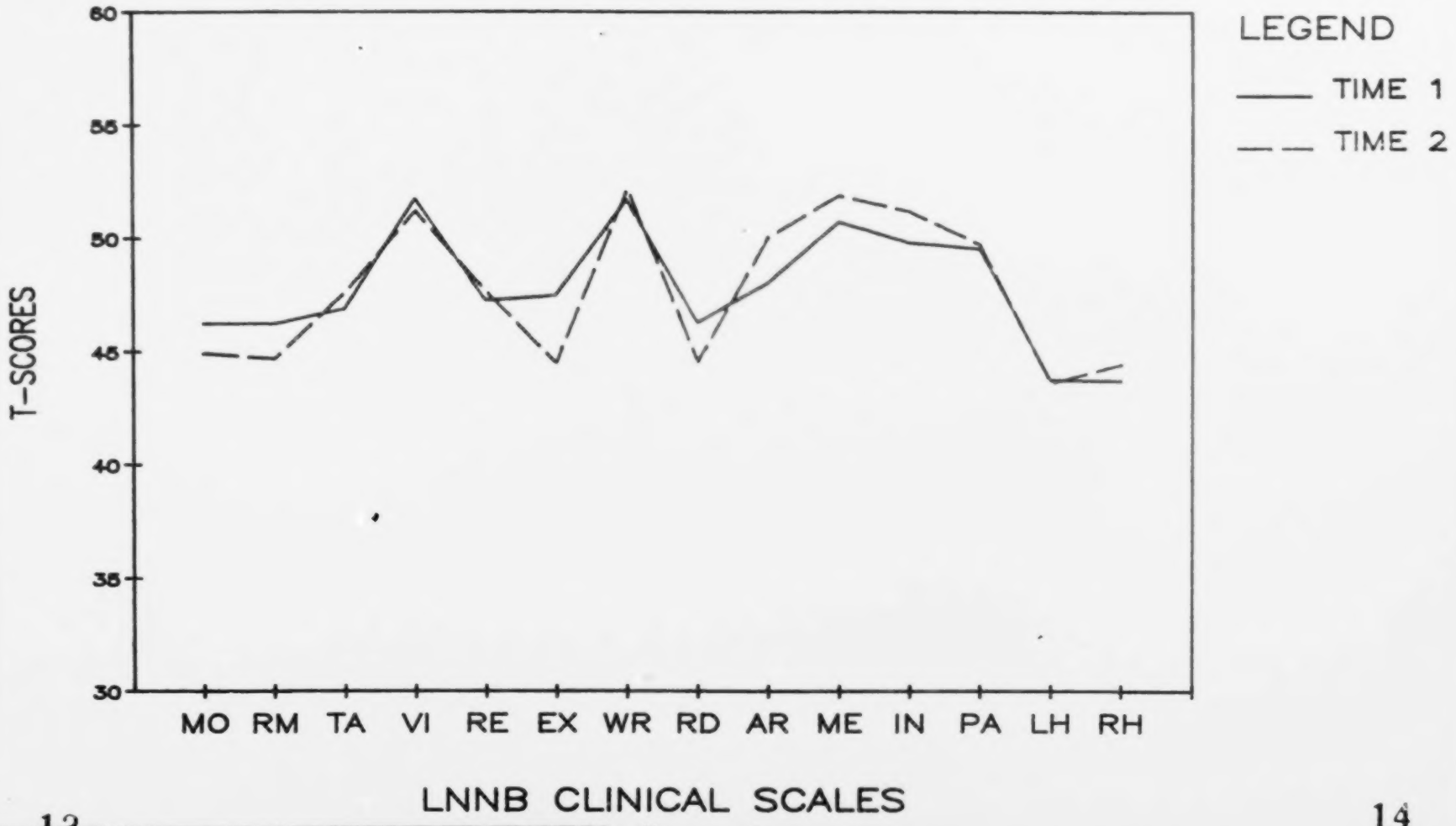

FIGURE 2
Longitudinal Changes in LNNB Clinical Scales Comparing Males and Females

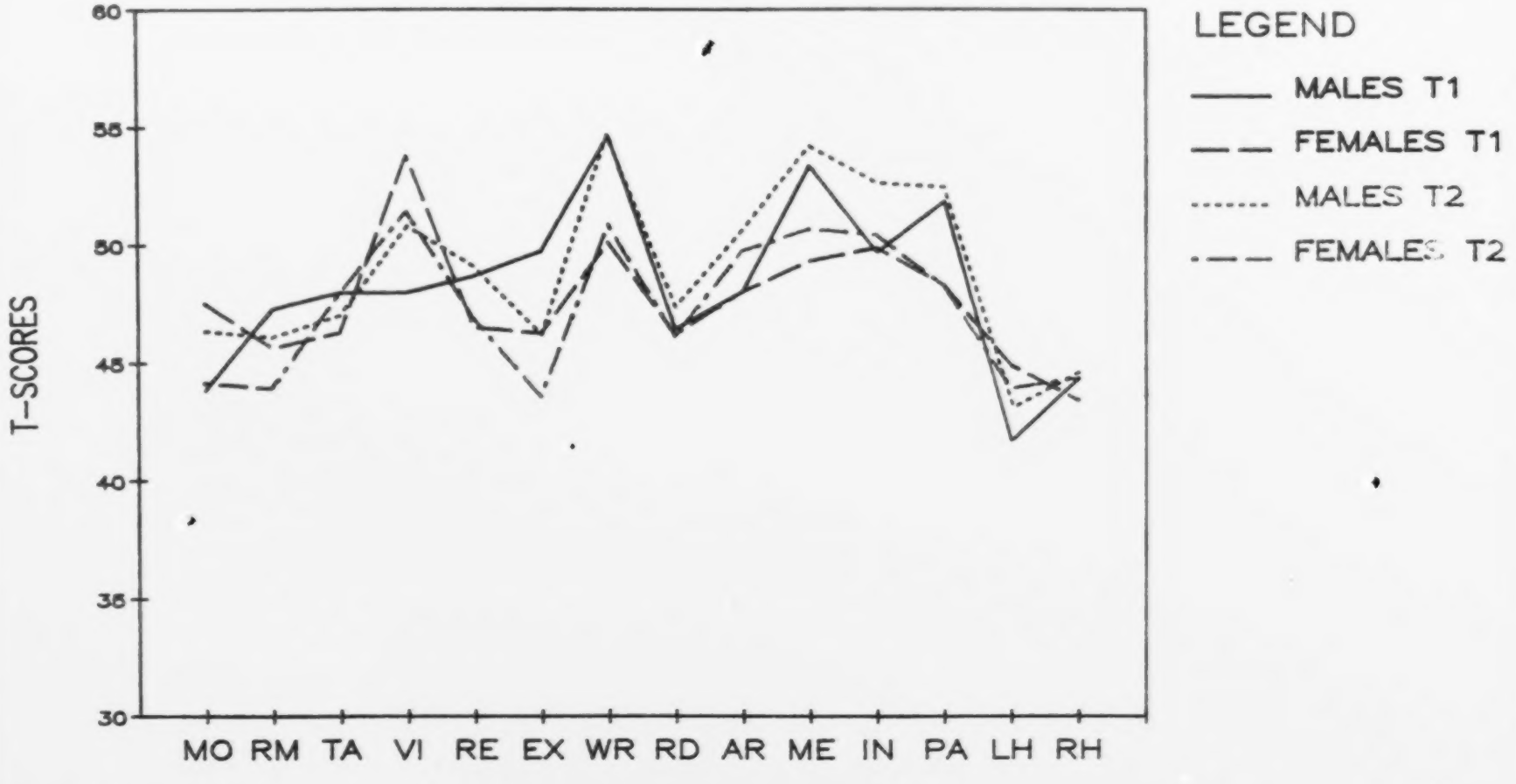

FIGURE 3
Longitudinal Changes in LNNB Clinical Scales Comparing Young–Old & Old–Old

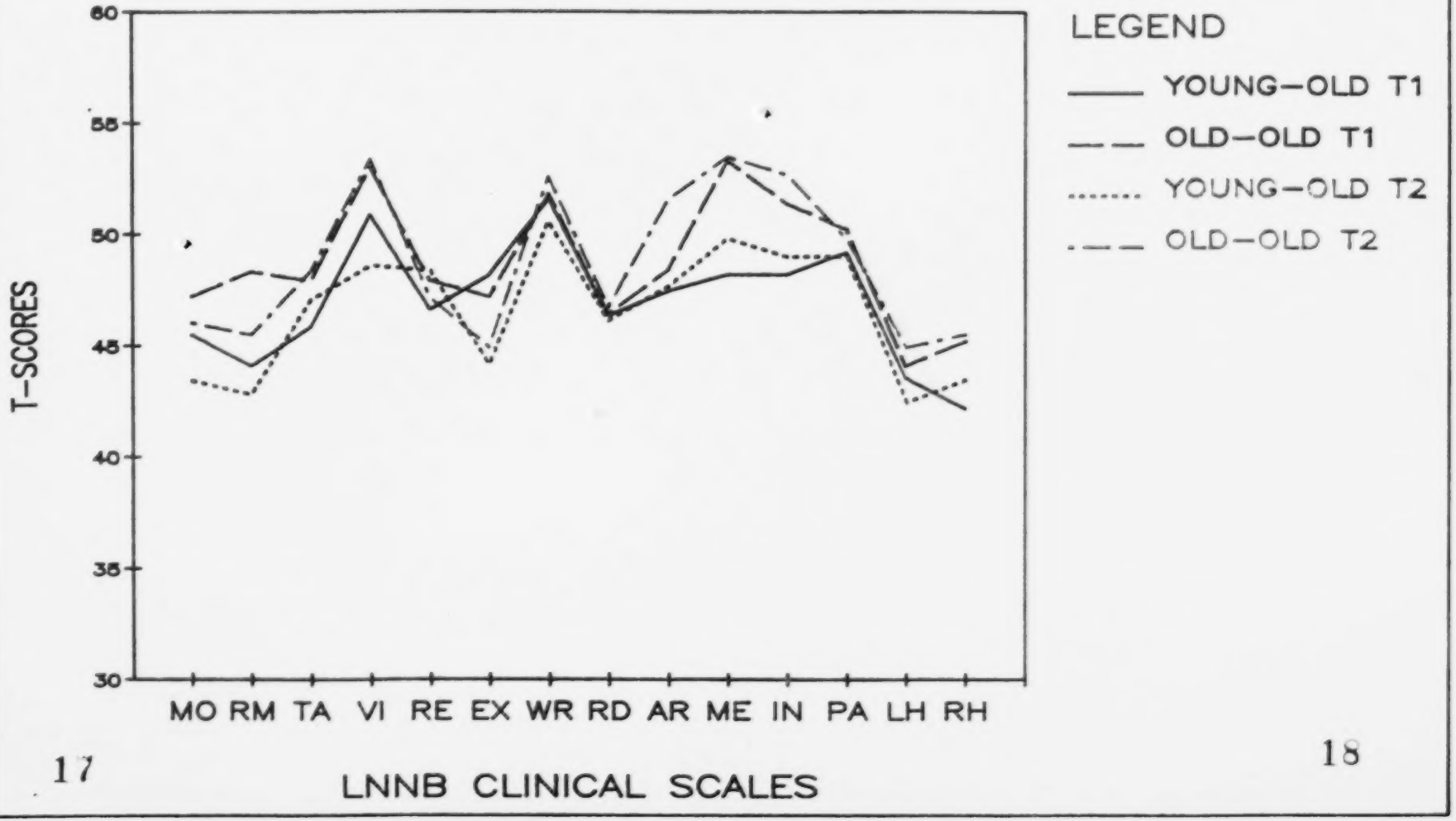

FIGURE 4
Longitudinal Changes in LNNB Clinical Scales Comparing Healthy & Mildly–Ill Elderly

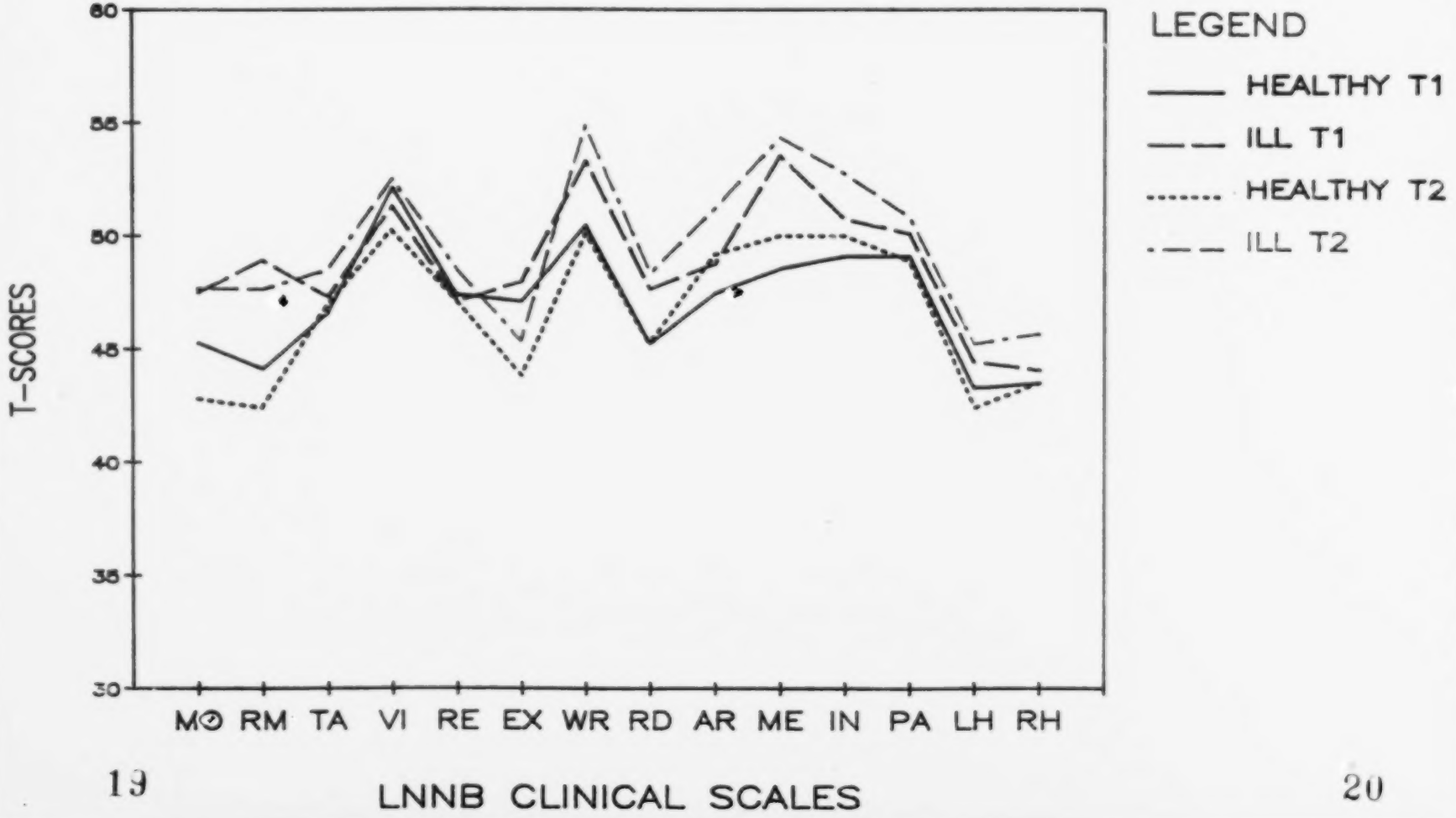

TABLE 5
Longitudinal Changes in LNNB Localization Scales in a Normal Elderly Sample

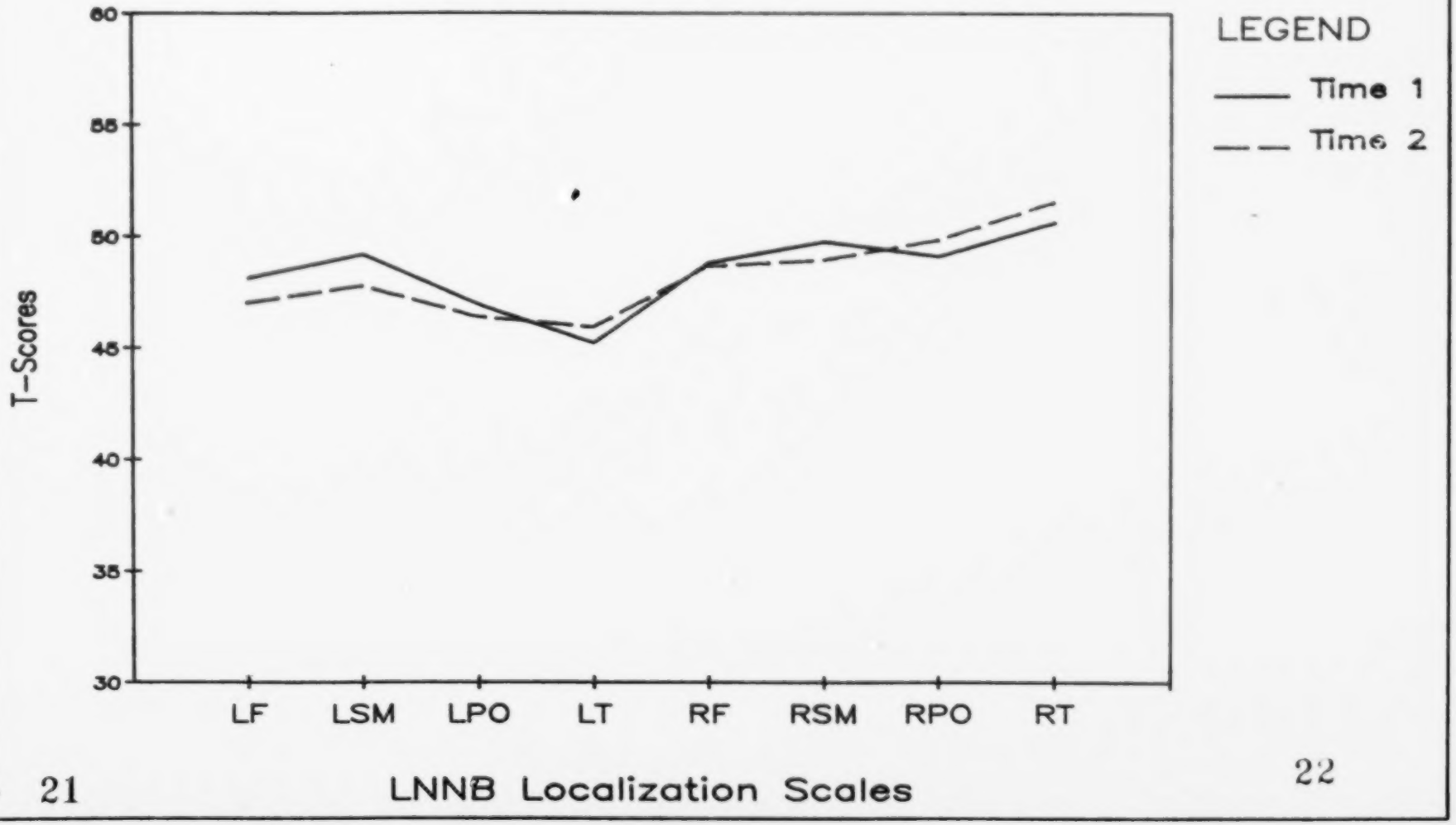

FIGURE 6
Longitudinal Changes in LNNB Localization Scales Comparing Normal Elderly Males & Females

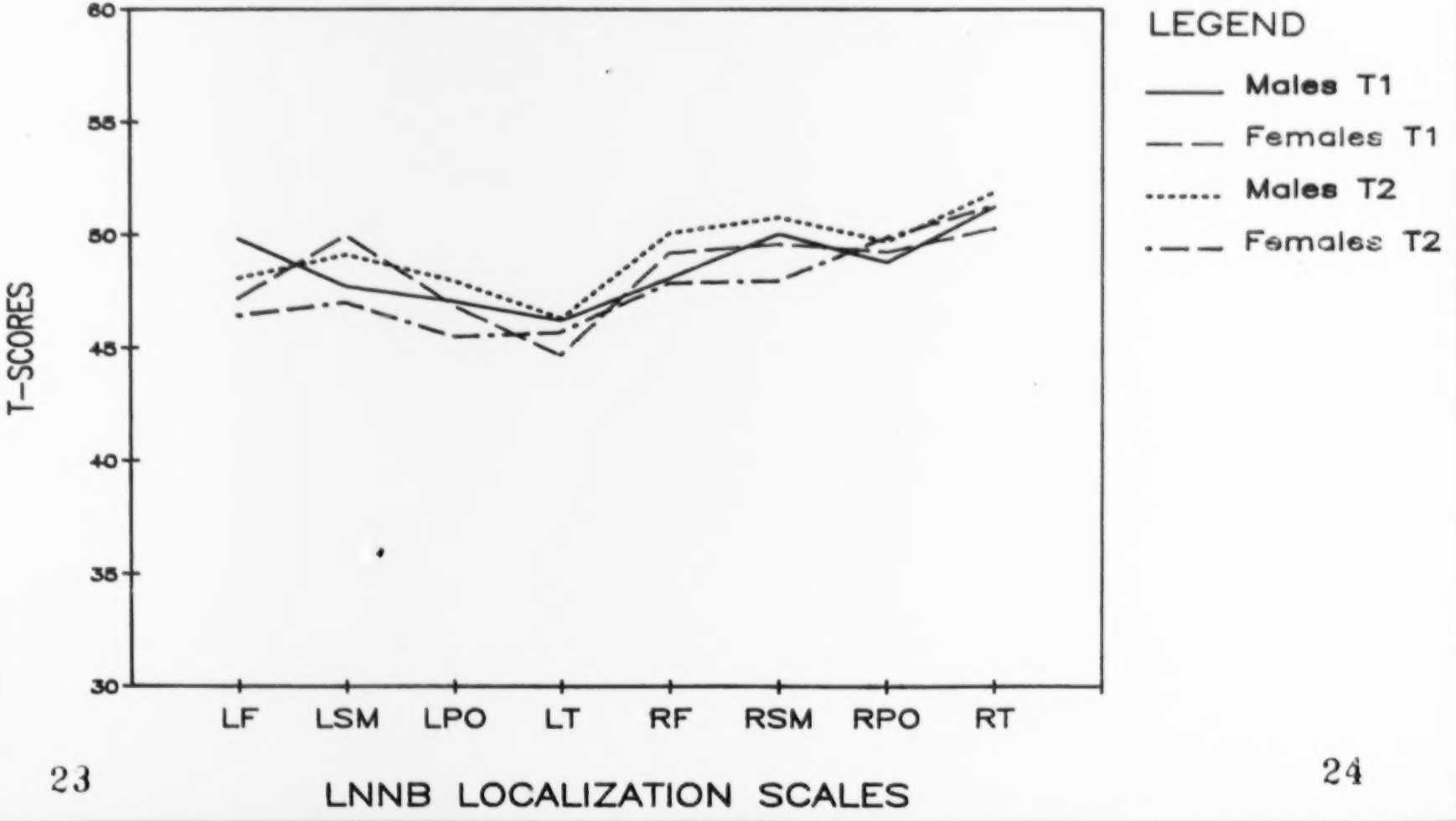

FIGURE 7
Longitudinal Changes in LNNB Localization Scales Comparing Normal Young–Old & Old–Old

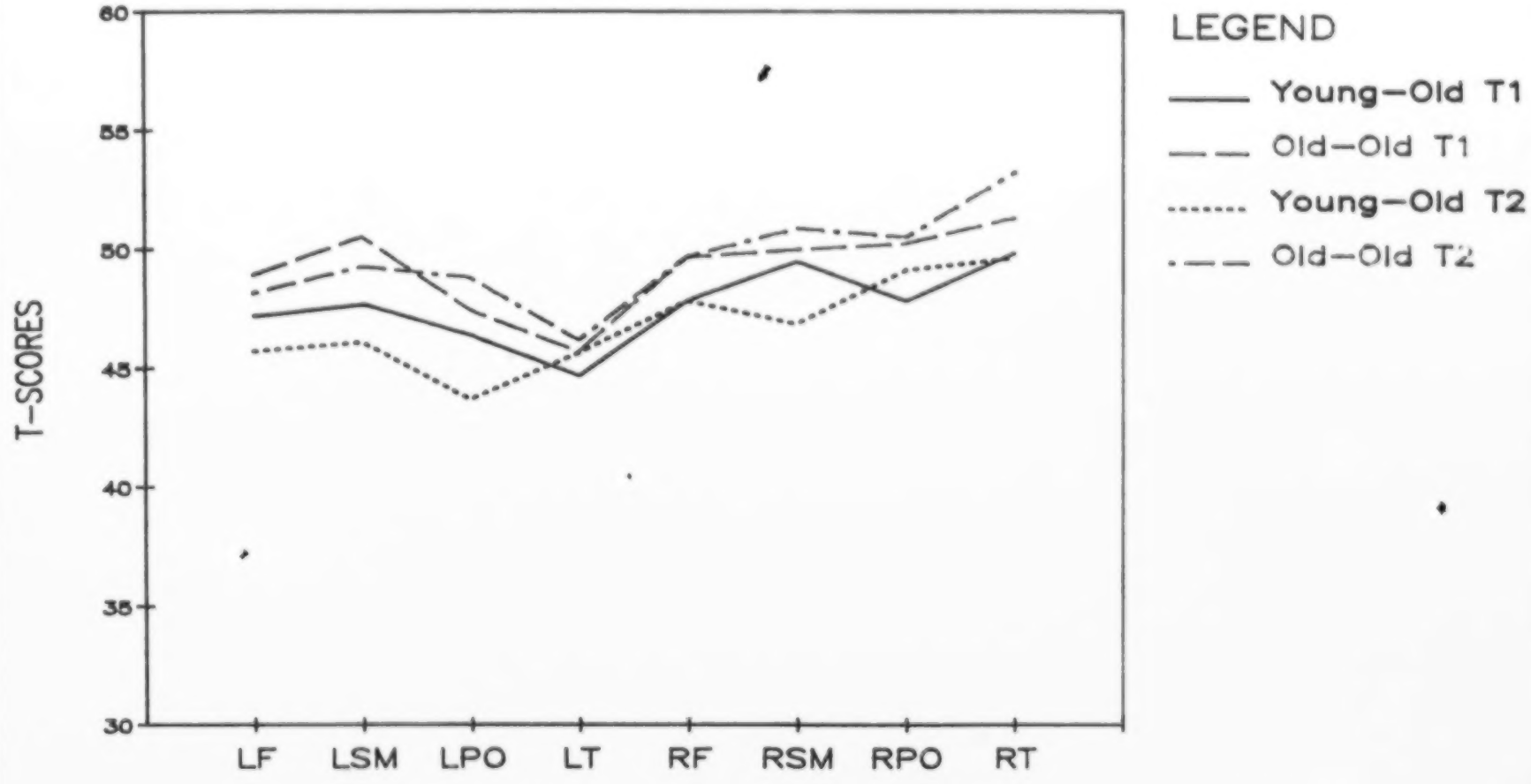

FIGURE 8
Longitudinal Changes in LNNB Localization Scales Comparing Healthy & Mildly-Ill Elderly